

SUPPLEMENT.

The Mining Journal

RAILWAY AND COMMERCIAL GAZETTE:

FORMING A COMPLETE RECORD OF THE PROCEEDINGS OF ALL PUBLIC COMPANIES.

No. 1850.—Vol. XLI.

LONDON, SATURDAY, FEBRUARY 4, 1871.

PRICE FIVEPENCE.
PER ANNUM, BY POST, £1 4s

Original Correspondence.

BIRMINGHAM AND THE BLACK COUNTRY—No. VII. THE WORKS OF THE NEW BRITISH IRON COMPANY.

After an hour's brisk walk from Dudley, on Saturday morning last, we arrived at the Corngreaves Ironworks, which are situated a few miles from Birmingham, near the village of Cradley. There is a somewhat interesting history connected with these works, which we will briefly notice. They were founded by Attwood, at one time a working nailer, but who, by dint of industry, saved money enough to commence the manufacture of iron. John Attwood, his son, carried on the works at the death of the father, and, after proving very successful, negotiations were entered into by him, about the year 1826, with the British Iron Company for the sale of the whole of his works and mines, amongst them being the Corngreaves Works and Corngreaves Hall. The amount asked was considerably above 500,000*l.*, and the British Iron Company, who were at the time owners of works in Wales, sent their agents to examine the books, and inspect the works and mines. Upon receiving the report of these agents the company concluded the negotiations, but after taking possession of the property they refused to pay the sum agreed upon, alleging that Attwood had made false returns and representations, and, consequently, they had purchased property that had no existence. Upon these grounds action was taken against Attwood by the company, at the Stafford Assizes, and these proceedings were carried into the Court of Common Pleas, the Court of Exchequer, and the Queen's Bench; the case was also sent again to the Stafford Assizes, was twice tried in the Court of Chancery, before Lord Brougham and Lord Lyndhurst, who gave adverse decisions, and it was ultimately settled in favour of Attwood, in the House of Lords. This extensive litigation is said to have led to the ruin of the British Iron Company, and, Phoenix-like, out of the ashes arose, in 1844, the present New British Iron Company. The latter company have remodelled the works, so that they are now one of the most complete in South Staffordshire. They are amongst those that have gained for this district the reputation it has so long held as a producer of first-class iron. The brand of the New British Iron Company is the lion, and it is scarcely necessary to speak of the quality of the iron bearing this brand when we state that, although orders are not solicited, the works, as a rule, make full time, and produce about 600 tons per week. Mr. J. P. Hunt is the general manager; and it will also be remembered that he is Chairman of the South Staffordshire Iron Trade for this year. It was our intention to have described the whole of the principal ironworks in the Black Country before noticing the blast-furnaces and collieries, but as these works are so compact and connected we find it necessary, at least, to take the furnaces with the ironworks.

On arriving at the works on Saturday last Mr. Hodgetts, the furnace manager, was placed at our disposal by Mr. Hunt, and the six hours spent in the works and collieries were fraught with interest, and to some degree with instruction. The furnace yard is about the best arranged we have seen in this district; it covers a large area, and is not confined and cramped as regards space, as is so often the case hereabout. The coke used in the furnaces is all burned in the yard from coal raised in the collieries. It is burned in large heaps around six coke chimneys, of which there are 150 in the yard. The native white and gubbin ironstones are the produce of the estate, and are calcined near the furnaces. The North of England red and the North Staffordshire brown hematites are used as mixtures with the stone. The blast-furnaces are six in number, four stand together in a line, and the other two, which are of more modern construction, stand a short distance from them. They are all built of red brick, lined with white fire-brick, and hooped with wrought-iron bands. The four older furnaces are 46 ft. high, and average about 15 ft. diameter in the boshes. The materials are raised to the top by means of two lifts—one an air-lift, worked by the blast-engine; the other a double one, by a vertical engine working direct, by means of a drum and wire-ropes. There are six hot air-ovens, in which the blast is heated for these furnaces. Two of them are fitted with pipes of the syphon form, 10 in. by 3 in., inside measurement, 30 pipes in each stove. The four other ovens have round double pipes placed in a circle, 24 pipes to each. The two other furnaces, as before stated, are of a more modern date, and are 43 ft. high by 17 ft. diameter in the boshes. They are fine looking, and would have almost perfect proportions were they a few feet higher. The cinder is taken from these upon an exceedingly good principle; rails are laid close up to the falls, upon which a trolley is placed. A square frame, made of swinging sides, is fixed upon the trolley by means of wedges; the cinder is then run till the frame or mould is filled, and allowed to cool; as soon as it is set the wedges are knocked away, and the sides of the mould fall back, and leave the cinder lying upon the trolley, which is drawn clear away. There are two of these moulds to each furnace, so that the one can be used while the cinder is cooling in the other. The blast is heated for these furnaces in four ovens, two to each, furnished with syphon pipes. The materials are raised to the top upon a double lift, worked by a vertical engine attached direct to a drum, upon which wire-ropes are used. This last-named engine has a very peculiar motion, the piston-rod being kept straight by curiously-arranged radius rods, slide bars, &c., are entirely dispensed with.

The pressure of blast used in the furnaces is 4 lbs. to the square inch, and is produced by two powerful beam-engines. The first has a steam cylinder 52 in. in diameter, and works a stroke of 8 ft.; the blowing tube, 104 in. in diameter, is at the opposite end of the beam to the steam cylinder. The beam at the steam end is extended in an upward curve, and attached, by means of a large connecting-rod, to a crank and shaft, upon which a 20-ton fly-wheel is fixed. The valves of the steam cylinder are worked by cams upon a small shaft, kept in motion by means of gearing connected to the fly-wheel shaft. Six cylindrical egg-ended boilers supply the steam for this engine. The second engine has a cylinder 51 in. in diameter, and works a stroke of 8 ft. The blowing cylinder is 103 in. in diameter. This engine is similar in construction to the other, with the exception that the valves are worked by hand gears and the air-pump rod, instead of cams. Under the same roof as this engine there is a small double-cylinder donkey-engine employed in pumping water. Near this engine there are ten cylindrical boilers placed side by side; part of them are used for this engine, and the others for the ironworks.

The object in placing them so many together was that they might at some future time be heated by the waste gases from the blast furnaces. The stack or chimney is also built large, so that it may be used for drawing off the gases when required. At present slack or small coal is used for heating the boilers, as it is supplied at a very low cost from the company's own collieries, where large quantities are necessarily made in getting the coal, because of its inferior quality. Four of the furnaces are now in blast, and the average yield of pig-iron is about 900 tons per week; 273 tons of cold-blast iron have been cast from one furnace in a week, and it is not an uncommon thing to have 20 tons of hot-blast pig at a cast. This is an exceedingly large produce for South Staffordshire, and, indeed, any district when the size of the furnaces is taken into consideration. The furnace hearths are composed of large fire-bricks made in the works, which are found to answer much better than stone. They are made of a wedge shape, and so fitted as to prevent the hearths from lifting.

The tuyeres used are Mr. Hodgetts's patent; and as they are, we think, the best in use, and have so long been worked with such a good result, we will here explain them. The tuyere in some respects is similar to the ordinary ones, as it is composed of two metal cones or shells, which are so welded together as to form a hollow truncated cone. The patent tuyere differs from the ordinary one in that a small pipe is conveyed from the back end to within a short distance of the nose, or that part which protrudes into the furnace, and is exposed to the most intense heat where it is connected to an annular pipe. This annular pipe is pierced by a series of small holes or jets, which face the inner surface of the nose, and has immediately behind it a flange or collar, which is welded to the inner shell, and extends nearly to the inner surface of the outer shell, leaving only a small space for the water to flow through on its way back, and thus forming a cold-water chamber at the nose of the tuyere.

The action of the tuyere is as follows:—The water enters by the pipe which traverses the interior of the cone, and delivers itself through the holes of the annular pipe upon the inner surface of the nose. After cooling that part it is made to traverse the small space, or cold-water chamber, between the flange and the outer shell, thus protecting the latter. The water then, after filling the whole of the hollow space between the cones, takes its exit by an aperture at the bottom of the tuyere in the ordinary way. This patent tuyere has now been in use at all the furnaces at the Corngreaves Works for several years, and it is found that so long as it is kept supplied with water to act exceedingly well. The continual flow of water upon the nose keeps it perfectly cool, and consequently free from injury, so that the tuyeres last much longer than ordinary ones; some of them have been at work so long a time as two years. The cool state of the nose prevents the melting iron from adhering to it, so that there is no necessity for the frequent changing of the tuyeres, and the blast is thereby kept longer on the furnace, and the result is improved working and an increased make of iron. The increase of the make from this cause has been found to be no less than 10 per cent., so that it is estimated, taking all things into consideration, that a saving of over 3*l.* per week for each furnace is realised where these tuyeres are used. One good feature in them is that they are much safer, and not near so liable to burst as are those of the ordinary type. We would strongly recommend the use of them to all proprietors of blast-furnaces, as they are not only economical but safe, and less liable to endanger the lives of their workmen. Messrs. Hill and Smith, of the Brierley Hill Works, Dudley, are the makers.

In reference to the Corngreaves blast-furnaces, we can only say that they are in many respects a pattern for the Black Country. They certainly have not yet adopted all the new improvements, such as taking the gas off and burning their mine in kilns; but the reason for this is, as we have stated, they have an abundance of fuel which would otherwise, likely enough, not be utilised; and yet they have a long time since made every preparation so that these additions can easily be made when required.

COLLIERIES IN NORTH DURHAM, THEIR WORKINGS AND MACHINERY—No. VII.

WASHINGTON COLLIERY.—This coal field has been worked during a period of more than a century in the Upper seam. Nine pits have been put down, first to the Main Coal seam, which is found here of excellent house quality; its depth is moderate, but about 30 fms. of sandstone (the grindstone post) requires to be penetrated before this seam can be obtained. As the Main Coal seam became exhausted several of the pits have subsequently been sunk lower, to the Hutton seam, intersecting in the sinking the Maudlin, or Bensham, and the Low Main seams. The property, about 1200 acres in area, is leased by Messrs. Stobart, Bell, and Partners, their chief viewer being Mr. J. Willis. At the present time coal from the four seams above named is raised at one pit only—the F Pit, which is 10 ft. in diameter, 110 fms. in depth to the Hutton seam. This pit was deepened in 1856 from the Main coal to the Hutton seam. Coal working commenced in the latter in 1858. This is also the pit for the ingress of air to the different seams; 30 fms. of cast-iron tubing is inserted, which excludes the water at the grindstone post. The A Pit, 600 yards distant from the F Pit, is the return air-pit, on which a Lemiel ventilator is erected to produce the circulation of air in the mines. The F Pit is divided into two equal sections by 3-in. plank brattice. In each section about 250 tons of coal is raised daily by a separate engine. The west winding-engine is a 31½-in. cylinder, 6-ft. stroke, direct-acting beam-engine, with 14-ft. cylindrical drum. It raises coal from the Low Main level, 100 fms., with three-decked cages, three 7-cwt. tubs in each cage. Steam is supplied to it from three plain boilers, 30 by 5 ft., at 30 lbs. pressure; these are uncovered. The east winding-engine is a 41½-in. cylinder, 6-ft. stroke, direct-acting beam-engine, 14-ft. cylindrical drum, 21-ft. fly-wheel, with foot-break acting on the under half of it. It raises coal from the Hutton seam level, with three-decked cages, three 7-cwt. tubs in each cage. A small lever-engine placed in front of the latter, of 15-in. cylinder, 21-ft. stroke, pumps water from behind the tubing to supply the cottages near the colliery, in one lift of 32 fms., 8-in. bucket. This engine has a drum which may be connected to it, and serves as a jack. Steam is supplied to these engines, and two other engines placed underground, from six plain boilers, 42 by 5½ ft., each suspended from four girders, at 30 lbs. pressure; these are uncovered. Each range of boilers is fed by the respective winding-engine. Water is raised from the Hutton seam by the east winding-engine, in wrought-

iron tanks, which replace the cages for eight hours each night. Each tank contains 400 gallons of water; about 480 of these are lifted each night—850 tons of water. Six screens are erected for each pit, inclined in contrary directions; these, with the platform and roofing, are constructed of wood. Two engines are placed underground for the double purpose of hauling coal and pumping water from the dip; the latter is done at night only. The machinery and appliances by means of which the water is lifted are well worthy of notice.

The LOW MAIN ENGINE, placed in the Low Main seam, about 40 yards to one side of the pit, has two 16-in. horizontal cylinders, 13 ft. apart at their centres, 2½-ft. stroke, wheels in ratio of 1 to 3; one 4-ft. drum, 21 in. wide. The engine-plane (the least gradient of which is 1½ in. per yard, chiefly 3 in.) proceeds from the pit, S. 74 E., for 600 yards; from this point it diverges two ways, one branch going in the same direction to the Maudlin seam, the other branch continuing in the Low Main seam, N. 84 E., a further distance of 600 yards. At this extremity the pump is placed, having in connection with it 1200 yards of 4-in. main pipes, in one lift to the pit. The pump has a 6-in. plunger, double-acting, 18-in. stroke, and direct-acting, making 30 strokes per minute for 10 hours each night, and is driven by an endless wire-rope from the engine, which simply passes over two vertical wheels, with grooved wood curbs fixed on their circumference. The wheel at the engine is 7 ft., that at the pump is 4 ft. in diameter. The total vertical lift in 1200 yards is 90 ft. At 3½ gallons per stroke, 108 gallons per minute will be delivered, equal 289 in ten hours. From the point of divergence in the Low Main seam (600 yards) the other branch, after crossing a dip fault, is continued S. 74 E., as a stone drift, at an inclination of 1½ in. per yard, until the Maudlin seam is reached, the engine-plane being extended in this seam to the length of 1800 yards from the pit. Both Main coal and Maudlin coal is brought from this point. Maudlin coal is also got from two intermediate branches higher up the plane. The empty tubs, 35 in each set, run in by gravity; the laden tubs are hauled from the extremity, 1800 yards, in ten minutes. This engine furnishes the supply of coal for the west pit.

The HUTTON SEAM ENGINE is placed in that seam, 20 yards west from the pit. It has been in operation eight years, and operates on the east engine-plane, 2100 yards in length. It has two 28-in. oscillating cylinders, 6 ft. apart at their centres, 4-ft. stroke, working by friction gearing—a 4-ft. pinion, and 8-ft. spur-wheel; the latter gives motion to another 8-ft. wheel, on the shaft of which the drum is fixed, 8 ft. in diameter and width, put in or out of gear by slide carriage. On the opposite side of the engine another 7-ft. spur-wheel and shaft are fixed, also worked by the pinion. From the 7-ft. double-grooved wheel on this shaft the pumps are worked by endless ropes, in two lifts; this shaft is put in or out of gear by slide carriage. There are altogether four shafts. The pinion and spur-wheels are all nine-grooved friction wheels. The pump at the lower lift in the Hutton seam, 2100 yards from the pit, has one 8-in. vertical barrel, double-acting plunger, 2-ft. stroke, 600 yards length of 5-in. main pipes, 180 ft. of vertical lift. The endless rope and wheels are similar to those at the Low Main engine. The workings beyond this pump are drained by a horse-crank, with three rams and 300 yards of main pipes.

The upper lift of pumps has one 7-in. vertical double-acting plunger pump, 3-ft. stroke, going 14 strokes per minute 10 hours each night. The endless rope giving motion to it is passed over one groove of the 7-ft. double-grooved wheel at the engine, thence to a 4-ft. single-grooved wheel, 20 yards from the former; the rope is then taken back, and passed over the other groove of the 7-ft. wheel, and runs from thence in the direction of the pump. A similar arrangement is made at the pump end to give the requisite grip, in order to work the pump, and force water up the great elevation of 300 ft. vertically, and 1500 yards in length of main pipes, 6 in. diameter. Calculating 10 gallons lifted per stroke, this pump will deliver 375 tons of water in 10 hours. Coal is hauled from two points on the engine plane, from 1900 yards distance from the pit and an intermediate point. The empty tubs run in by gravity, 45 tubs at once, from which the east pit is supplied. The steam for both engines is brought from the surface boilers in 11-in. wrought-iron pipes to a receiver, from whence it is distributed to each engine. The escape steam is conveyed through a flue, a portion of which is brickwork, to the A, or return air pit. A hauling engine on the Maudlin seam—not in use at present—has two 15-in. horizontal cylinders, 2½-ft. stroke, wheels in ratio of 1 to 3; two 4-ft. drums between the engines, on one shaft with a clutch, working tail and main rope: 5 horses and 30 small ponies are also employed in conveying coal underground.

UNDERGROUND WORKINGS.—Section of the Main coal seam:—
1.—Blue metal roof, with ironstone.
2.—Top coal 0 ft. 10 in.
3.—Band 0 2
4.—Bottom coal 2 8=3 ft. 8 in.
5.—Good fire-clay, not used 1 6

The Maudlin seam is 4 ft. 8 in. in thickness, including 2½ in. of splint separated from the good coal and left underground, grey metal roof, inferior fire-clay under the coal. The Low Main seam varies from 3½ to 4 ft. in thickness of clean coal, is used for steam purposes; grey metal roof, inferior fire-clay under the coal. The Hutton seam has blue metal roof, good coal from 2 ft. 8 in. to 3 ft. in thickness, fire-clay with ironstone balls 6 ft. and lower coal not worked.

In all these seams coal is got on the bord and pillar system. The pillars are made 40 by 25 yards, the bords and walls 3 yards in width; thus 1-6th of the entire coal is obtained in the first working, and 5-6ths is left in pillars. The cleavage runs both north and south and east and west; the latter is generally the most distinct. The dip of the measures is eastward about 3 in. per yard. Fire-damp is emitted freely from most of the seams. The usual practice in the whole of the seams is to drive the bords in panels of twelve, either north or south, the wagon-road at the dip side of the panel being defended by a pillar on each side 40 yards in breadth. The whole of the pillars intermediate from this to the highest bord but one are removed, following closely the whole or bord workings. The highest bord on the rise is maintained as an air-way, which the pillar next to it is left to protect. This plan, which is a highly commendable one where much gas is to be dealt with, permits a large proportion of the gases in the goaf to escape naturally into the air-way, and to be swept away by the return current constantly passing therein, and prevents any overflow of gas at the dip side or at the working places. It will be seen that the two 40-yard pillars, and the pillar to the dip of the return air-way together, of two adjoining panels, form a convenient breadth to be worked back by a subsequent operation. Working lamps are used both in the whole working and in the pillar working of the

four seams. Powder is used in both whole and pillar workings in the three upper seams; it is not used in the Hutton seam. The firing of shots is permitted to be done only by authorised men specially appointed for this purpose, and this after a careful examination of adjacent parts of the goaf shows that it can be done safely. This care, together with forcing air over the working edge of the goaf into the return air-way, and the natural drainage of gas into that air-way, has hitherto been effectual in preventing accidents in this department of the work. It is greatly to be desired, however, that some less dangerous method of breaking down coal than blasting could be introduced, having equal efficiency, so as to do away with the great risk which it is admitted appertains more or less to the process of blasting in fiery seams. We feel assured any mechanical contrivance as a practical substitute for this purpose would be a great boon to the overlookers and workers in coal mines.

The pillars are removed in 5-yard lifts, driven east and west 12½ yards from each bord, one pillar being 5 yards in advance of that below successively. A row of chocks is placed in the middle of each lift, 4 ft. apart, and props occasionally where required. It may be stated that the long wall system of working has had a trial in the Maudlin, Low Main, and Hutton seams, and was found to be adapted to getting the Low Main seam economically: the system was not persevered in, owing probably to the prejudice of the men to any change in the mode of working.

The Lemelle ventilator, at the A Pit, has been three years in operation, its height is 24 ft., the chamber in which it works is 22 ft. in diameter! 17 revolutions per minute are performed, day and night, affording a circulation of air, distributed over the four seams, of 130,000 cubic feet per minute. To each panel of bords about 7000 cubic feet is assigned. When the ventilator was started, three years ago, the resistance in the mines owing to contracted air-ways was considerable, about 5 in. of water gauge, and it is to mines worked under this disadvantage that this machine is thought to be more particularly applicable. Since its erection an improvement in the dimensions of air-ways has been effected, affording passages of 30 ft. sectional area a much reduced height of gauge. The ventilator is driven by a horizontal direct-acting engine of 48-in. cylinder, 6-ft. stroke; the steam is cut off at one-third stroke, and worked expansively, by means of two eccentrics and two slide-valves. The engine and ventilator were made at Lilleshall Works. Two Galway boilers supply steam at 40 lbs. pressure, each boiler is 30 ft. by 7 ft. in shell; two tubes, 3 ft. in diameter at the furnaces, unite into one 4-ft. tube beyond; in each 4-ft. tube there are 30 cross-tubes, 10 in. and 5 in. diameter at their respective ends. These boilers are completely covered with brickwork, level on the surface. The boiler feeder has two 9-in. inverted cylinders, two 8-in. rams, and 12-inch stroke. At the I Pit a winding-engine, and another engine for hauling underground erected at the top of the pit in the same house, formed at one time the principal plant; these are now out of use, having been superseded by the machinery and plant at the F Pit.

The coal from Washington Colliery is conveyed over the private line of the firm, two miles in length, by locomotive power, forming a junction with the North-Eastern Railway, by which it may be conveyed to the Tyne or Sunderland Docks for shipment.

[In the description of Stella Colliery, in the Supplement to last week's Journal, there was an error which I shall thank you to have corrected. The percentage of sulphur in coke is only .75.]

COLLIERY EXPLOSIONS—SAFETY-LAMPS.

SIR,—The constant recurrence of explosions in coal mines induces me to ask you to again make mention of my Patent Safety-Lamp for Mines or Ships, as described in the Supplement to the *Mining Journal* of May 28. The safety apparatus can be fitted to any sort or shape of lamp, whether burning oil, paraffin, or candle. The first attempt of the miner to open his lamp causes its instantaneous extinction; and as he proceeds to unscrew his lamp the safety apparatus catches the wick, and withdraws it from the socket. No lock, magnetic or other, is required; the lamp is its own lock, which is set on closing, and although so sensitive that the slightest attempt to open the lamp causes the extinction of the flame, still the mechanism is so strong that no amount of knocking or banging about can derange it.

Jan. 31.

ARTHUR H. GILMORE.

INDUSTRIAL AND TECHNICAL EDUCATION.

SIR,—I have been anxiously watching from week to week for some further particulars concerning the proposed National University for Industrial and Technical Training, noticed in the *Mining Journal* of Jan. 14, and which appears to me to be just the thing working men want—a properly constituted body to give degrees recognising the position of each man in his particular trade, instead of making all men study a settled set of subjects, no matter whether they be useful or useless to them. It is absurd enough to make a surgeon study Euclid and other matters that can only be useful to engineers, while engineers must study chemistry, which is of no use except to medical men; but in those cases the students are generally well furnished with means, so that some waste of time and money results merely in inconvenience, not injury; but with working men it is quite different. One engaged in an engineer's shop would readily learn elementary mathematics, mechanics, and the principles of mechanism (and that is what I expect would entitle him to the letter D degree); and the miner would gladly gain the letter C degree if he could get it by studying only geology and mineralogy; but if either of these men had to learn the subjects for the M degree or the N degree they would most likely say that a knowledge of agriculture would be of no use to them, as it would not even help them to make a ploughshare; and as to health, ethics, music, and gymnastics, they would refuse to go to a college to learn them, on the ground that they could be as well studied elsewhere. If they could not get recognition for studying what they can apply, without learning what they do not want, they would refuse to learn any of the subjects, and prefer to go on as at present.

It would, I think, much gratify the workmen connected with all trades if the officials of the National University would announce what degrees they intend to confer, and also what fees they think of charging. If no arrangements have yet been made, I should like to offer a suggestion or two. I think thirteen different sorts of degrees in one university would be too many, and this number would be increased when other subjects have to be learnt. And I do not see why my subjects (A, Mathematics, and Physical and Mechanical Technology), should be put below Fine Arts, for mechanical technology is as good I am sure as fine arts can possibly be; so I would say let there be only one degree divided into three classes for all the students of the University; let it be, for instance, "Master of Technics," first class, second class, or third class, according to the intelligence of the student. The title would be equally applicable whichever of the thirteen branches of Technical study the student devoted himself to, and by having one title for all there could be no jealousy. Seniority would be recognised only by position on the register, the first man in each of the thirteen classes being first registered, then the second man in each, and so on, the position of the first thirteen among themselves being determined by the alphabetical order of their names.

But besides the degrees and the fees, there is another thing in which workmen will feel equally interested—how is the possession of the degree to be indicated? This may seem a trifle, but just as "an Englishman loves a lord," so an Englishman, and especially a young Englishman, likes it to be generally known when he has distinguished himself. That the black night-dress and cup-and-saucer head-covering of the present university students would be acceptable to workmen I do not believe, but if something approaching the French decoration of the Legion of Honour were adopted the students of the National University could be given a distinguishing mark, of which they might be proud, and which, at the same time, would represent two important industries of the country—the ribbon trade of Coventry and the metal trades of Birmingham. A stout ribbon, 1½ in. square, and of the best quality, fixed between two horizontal gilt bars, and suspending a five-pointed enamelled iron star, 1 inch diameter, and bearing in the centre the letter indicating the class in which the degree has been obtained. The star should be the same for the three classes, but the ribbon should differ. Thus, for the third class, it might have red, white, and blue horizontal stripes, to show that the possessor has

still to rise; for the second class the stripes might be oblique, showing some progress upward; and for the first class vertical, to show that he has risen to the highest position. As the ribbon could be worn without the star, except on special occasions (just as the ribbon of the Legion of Honour is worn in France at present), so that the member of the National University would at all times be honourably distinguished amongst those with whom he might associate.

Hitherto I have seen but little published, except the article in the *Mining Journal*, concerning the University; and it was only after much enquiry that I ascertained that Dr. John Mill, of Westminster, is the principal gentleman connected with it. I have no doubt they have an excellent project, and one that will take well with the workmen, but to make a success of it the matter must be well ventilated in the newspapers. Dr. Mill could well commence by stating how he thinks of dealing with the subject in detail, and what degrees he proposes to confer.—*Birmingham, Jan. 30.*

A. O. F.

DYNAMITE.

SIR,—In addition to the advantages resulting from the use of Dynamite, mentioned in "J. G. B.'s" letter, in the Supplement to last week's *Journal*, allow me to call your readers' attention to its great safety. The fearful loss of life from the explosion of gunpowder in the Morfa Colliery, last year, is fresh in the memories of all, and we have now a further loss of life from a similar cause in the Swannington Colliery, occasioned by a collier snuffing a candle and throwing the lighted snuff on to the ground, thereby setting fire to a few grains of gunpowder, which served as a train, and exploded a barrel.

If dynamite had been used this could not have taken place, for if any quantity had been set fire to it would have burned harmlessly away, without any explosion whatever. Dynamite has thus the double advantage of safety from explosion if it accidentally comes in contact with fire, as well as its easy explosion in wet ground and under water.

London, Feb. 1.

W. O.

MINING IN CARDIGANSHIRE AND MONTGOMERYSHIRE.

SIR,—In looking on past events in Cardiganshire during 1870, we have every reason, taking matters generally, to be satisfied with what has occurred. Taking the Dividend Mines as they appear in the *Mining Journal* List, we may begin with Bronfloyd, which has greatly increased its dividends and reserves; and we may fairly look forward for a continuance of that prosperity, and, I should say, an increased rate of dividends. The eastern ground added to the grant is a great acquisition, and will be found rich as soon as the deeper levels are extended through it. Bwlch Consols has spent large sums of money in machinery. It is looking well, and opening out on a north lode, on which good discoveries may be reasonably expected, and a better 1871 than 1870 looked forward to. Cwm Erfin, which has had a good and long run of dividend-paying years, is fast coming to a calling mine. The water in this mine was let in for years, during a time of profits, and nothing done but in the shallow levels—hence the present state of affairs. Cwmystwith, the oldest and once the richest of the mines in this county, ceased giving profits in 1870. Let us hope it may have a better fate in 1871. East Darren is opening out and paying dividends, and with adequate drawing machinery, could greatly increase them. The Lisburne Mines may be considered never failing. They comprise a district in themselves, and many rich mines, the deepest of which have only obtained a comparatively shallow depth. The dividends undoubtedly will be kept up much as they are at present, and may safely be concluded to do so by the shareholders during the present century. South Darren has been opening out about as much as it has been selling; it is a good property, and would, with an increased field of machinery, pay larger dividends.

Then come the mines giving regular profits, but which have not yet declared dividends. Bwadrain during the past twelve months has added greatly to its machinery, which is now nearly perfect. For the outlay incurred it is giving a good percentage, leaving about 1500*l.* per annum on the right side of the ledger. Powell United is opening out extensive reserves, and will require increased power to make the returns it is capable of doing. This property with the present returns is leaving 1800*l.* per annum to the credit side of the ledger. Plynlimmon, having completed its machinery, is now in a position to give from 2000*l.* to 2500*l.* per annum in the shape of profits. Llywernog United has spent a great deal of money both in surface and underground improvements, and is now capable of being worked profitably. Clara Consols, being a mine only started a few months, may be looked upon as a very safe investment, and will before the end of the present year more than pay its expenses. I may here remark that, with proper management, and a moderate capital to back it, success is invariably the rule in this county. Captain Northey has lately brought this, the Bwadrain, and Bwlch Consols from a non-paying to paying properties, thereby enhancing the interests of the shareholders, and doing incalculable good in the immediate vicinity of the mines. Blaen Caelan, in the neighbourhood of and adjoining the celebrated Esgair Her Mine, the Great Potosi of Cardiganshire, has during 1870 been extensively worked, and great discoveries made, so that a few months must put this mine into a dividend-paying concern. In this case also let us see what perseverance and capital has achieved in this county.

Mr. Balcombe stands at the head of Bronfloyd, Llywernog United, and Blaen Caelan—the first one of the best dividend mines we have, the two latter safe to become so. He has also the management of Dolwen, to the east of Bodecill, where they are now talking of commencing with ore flooring. This, to me, has a peculiar charm, and prepares one for what it is going to do. These four mines are the means of paying many thousands a year to all classes in the county, as well as an excellent interest to the shareholders, and what good they are really doing cannot be estimated.

Cefn Cwm Brwyno, a mine sold recently, supposed to be poverty stricken, has revived with a little capital expended judiciously, and will, I have no doubt before the present year expires enter the list of dividends. Llwyn Teify, one of the most extensively wrought of the oldest mines that I am acquainted with in the county, has been cleared to the bottom, and levels driven under the ore ground worked by the ancients. Here vast quantities of lead ore have been worked away, and the ground now opened can be taken away at 3*l.* 5*s.* per ton, or about 5*s.* in 1*l.* Two months more will complete a railroad into the ore ground, when good returns and profits will be made, and will continue to increase as the ore ground eastward is opened on for many years to come. Bodecill during the past few months has opened the richest course of ore in the district, and, being on the richest lode yet worked in Cardiganshire—the Frongoch—is likely to become as rich as that mine. Machinery is now being erected which, when completed, will also place this property in a good position, and leave the fortunate proprietor what he richly deserves—many a thousand a year for his pluck and judgment. Great Darren, which has also baffled so many, has had a splendid lot of machinery erected by the same party as the last mentioned, is working to the good, and cannot fail to become a rich mine. The Great Potosi (or Esgair Her) has been providing machinery for giving these mines a fair and effectual trial, and nine months and 1500*l.* expenditure will place them second to none that have yet been opened out in the scale of profits. It has already been the means of adding to the wealth of many noble families, and, if the required capital is forthcoming, will be the means of enriching others. Nant-y-Moeh, as a new mine, is one of the finest lodes, and is the finest trial now being carried forward in the county: 1871 will prove it. The necessary machinery is being erected, and the work contracted for to sink the mine to a 30 ft. level, a depth where the greatest masses of ore are generally found in the locality—East Darren, on which lode it is situated, having made rich bodies of silver-lead ore within a few fathoms from surface. A good course of ore has just been met at South Bwadrain.

I find my letter is now somewhat lengthy, but, as there must be a great number of shareholders in one and all of the mines I have mentioned, I found that, in order to give them anything like a fair account, I was compelled to fill more space than I first anticipated. It must not be supposed that Cardiganshire does not present a great many more mines even on the point of making profits than which I have here enumerated. There are several making returns which I could mention, and may do in another epistle soon; but it must be gratifying to find that at no period have the mines of Cardiganshire

presented appearances anything approaching to their present prospects, and it will be still more gratifying at the end of the present year if most of the mines I have enumerated, and which they will assuredly do, change places from progressive to dividend.

I cannot close with this county without touching on two most valuable properties, which, however, have come to grief within the last two months. They are the Nanteos Consols and the Rheidol United Mines. They have each of them good and powerful machinery erected. There is good ore in both of them, and each can be made profitable for 1000*l.*, after paying for leases and machinery, which may be estimated at another 1000*l.* Anyone, therefore, with a small capital may know where to make good use of it, and, as far as my means will admit, I shall be only too glad to join in carrying them forward. To abandon them will not be permitted—of this we may rest assured.

The Montgomeryshire mines are moving slowly, and slowly they will move for some time to come. The district is altogether a new one in comparison with Cardiganshire, which has been worked from time immemorial. That there are great prizes, however, to be found is sufficiently attested by the Van, one of the richest lead mines in the county, and, speaking geologically, being situated in the same formation, and having the same productive causes—the Snowdonian range of mountains being in the centre of the two counties, Cardigan and Montgomery—there is no reason why the eastern ground (Montgomery) should not prove equally as productive as the western mineral basin (Cardigan).

Goginan, Jan. 28.

ABSALOM FRANCIS.

MINING IN CARDIGANSHIRE.

SIR,—It may be worthy of note that, notwithstanding the large number of mines that have been started and worked during the past year in this county, little progress has been made in their development, and very few have added materially to the ore sales. I do not wish to put a damper on the spirits of those capitalists who have paid their money to develop the resources of the county—far from it; but I would, if my advice is acceptable, offer it to those who, on account of their distance from the sites at which the operations that they support are being carried out, are unable to form so accurate a decision as to the relative values of the different undertakings as those who are on the spot, and conversant with mining enterprise. Not being a miner, I have no preference for particular mines; but being much interested in them, in consequence of the advantages derived from the additional trade they cause, I should wish for those who are interested, as well as for a continuation of personal advantage, that benefit may be obtained by one and all. During my residence in Cornwall, in which county I have observed many successive times of excitement, caused by the demand for mines, I have found that while many mines were developed, and brought to a profitable state on a small outlay, as many, if not a still larger number, on a very large outlay, never reached that profitable position; and I was enabled, from my intimate acquaintance with the mines and their managers, to ascertain the causes which tended to the success or failure of the undertaking. Many a good mining set upon which the hopes of capitalists have rested, and which has been favourably reported on by the first miners of the day, that has been worked, and through the ignorance of the managers, entirely failed to be remunerative, till it had been abandoned, and gone into the hands of some other parties more competent to conduct its workings. Many a good mine has been lost to its promoters by extravagant and useless expenditure of their capital; and many a company has been formed simply to work ground for the benefit of unprincipled adventurers, who live upon the losses of others. On the other hand many have been observed mines energetically prosecuted by a small company of miners; and although their means have been very limited, their judgment in selecting ground, and the practical way in which they conducted their operations, seldom, if ever, failed to lead them, sooner or later, to a satisfactory result.

It is not so easy to enumerate examples of all these cases in almost any district, either in Cornwall, Devon, or Wales, but my object at this moment is to allude simply to Cardiganshire, where I believe there is still to be found not only good mines, but also very many good sites for mining operations which have not yet been explored, and I would strongly advise capitalists not to lose sight of some of those which during the past 12 months have been energetically prosecuted; at the same time I would suggest that reliable information respecting any one they may prefer should be obtained before investing in them. May I venture to make a more particularly have periodically favoured the public with their opinions and advice through the medium of the *Mining Journal*, and although some are competent to do so, there are others who, because they happen to live in a mining district, or bear a similar name to men who have held a position as practical miners, inflict the public with their literary productions continually, without the slightest approval of the generality of your readers, and sometimes go so far as to endeavour to become recognised by offering to undertake mining operations for incredibly small sums, thinking, I presume, that mining adventurers are unable to discriminate between the claims of the practical man, who is continually employed in the management of mines, and the constant scribbler who, in order to earn an occasional fee, is obliged to resort to such tricks, or advertise his abilities as an inspecting agent. There are, as before stated, many good mines, many good sites for new operations, and many good men to consult and to carry out mining successfully, but they are not those whose names are so continually in print; and if the shareholder is to receive the benefit he deserves for risking his capital in the mines of Cardiganshire, he had better depend upon the advice of his broker in London than to consult any so-called practical men whose name he may meet with at the bottom of a confused mass of technical terms and worn-out quotations in the many publications which are devoted to mines and mining.

Aberystwith, Feb. 2.

MERCIAIR.

MINING IN MEXICO.

THE GUATIMOTZIN MINE, REAL DEL MONTE.

SIR,—It is now close upon three years since I first commenced addressing you on Mexican Mining. In most of the letters you were kind enough to publish I brought before the notice of your worldwide spread readers the principal causes of the enormous dividends given, from time immemorial, by rich mines in that country. I need not remind your readers that, according to Baron Humboldt, two-thirds of the silver in currency and other uses has been produced by Mexico.

What are the causes of such successful mining and continuous dividends for a period of more than two centuries? This question is easily answered, and these are the facilities offered by Mexico for working mines in a most economical manner, and competing in this respect with every other country. What constitutes a rich mine? Many things. What are these; certainly not the high percentage of its ores only, for I am acquainted with several rich mines abroad that cannot pay dividends; the facilities for working them economically are wanting—such as abundance of cheap labour, agriculture, timber, and water-power for pumping and crushing, and all these facilities are to be had in most of the mining districts of Mexico; therefore, persons ought not always to invest in rich mines, but in dividend-paying mines, and no country offers in that respect such advantages as Mexico. The rapacious devourers of dividends are miners' wages, for if these are high all other items rise in proportion. We will take, for example, several of the States of the Union, where a common labourer is paid \$4 a day, or 16*s.*, and skilled miners are paid as high as \$6, or 24*s.* In Mexico the former receive three reales, 1*s.* 6*d.*, and the latter from 2*s.* to 3*s.* a day.

In Real del Monte 7000 miners are employed, averaging 2*s.* per day, equal per month to 21,000*l.* The same quantity of men employed in the States, taking the average at \$5 per day, 210,000*l.*—difference in favour of Mexico, in one month, 189,000*l.*; per year, 2,268,000*l.* The economy in wages, in 7000 men employed, in one year in one district alone in Mexico would produce in dividends, as compared to most of those in the States of the Union, the sum of 2,268,000*l.*

In many of my letters I brought before the notice of your readers, the great results that were to be expected from the Guatimotzin Mine, and these were addressed principally with the object of cautioning a few shareholders in this mine, who reside in England, not to dispose of their shares. This mine is worked by a native Mexican company, and nearly all the shares are held in that country, and it was not an easy matter for the English shareholders to be furnished with disinterested and reliable data. And in this case more so, for some were placed in a position to be taken suddenly unawares. There lurking about several birds of prey, seeking whom they might devour.

I received several letters from those holding shares in England, and I am glad to say they were induced, through my representations, to hold on, and these were not made from mere hearsay, or from any interested motives (for I have never held any shares), but from a personal inspection of Guatimotzin and the Great Rosario Mines of Real del Monte, and on several occasions during my residence there, commencing from June, 1866. I used to call these two mines the twin sisters, for they are not only contiguous but on the same lode, and their levels running into each other.

At the time I induced the English shareholders not to part with their interest the price of each twenty-fourth of this mine was 3000*l.* to 4000*l.* They were selling in Mexico last month at 20,000*l.*; a friend in the City of Mexico informs me by this mail that the last price was 23,000*l.* The name of the last Emperor of Mexico, Guatimotzin, is now being brought forward in a most tangible manner, in the shape

of immense dividends. The Guatemala Mine at present is producing nearly 20,000,000 profit per month, or 240,000,000 per year, and I can safely state that this will continue for some eight years at the same rate. The reserves occupy a length of nearly 200 yards, and the height about the same as her twin sister, the Great Rosario, which produced in eighteen years 3,580,000,000 in dividends. I trust that the above practical results will prove the superiority of silver mining in Mexico to any other country. I will soon again bring before the notice of your readers one or two more mines in Mexico that are likely to do very well. I need not mention here, for I believe many of your readers are aware, that I have always made it a rule never to speak of, or bring before the public, any mine in which I am interested directly or indirectly, for if a mine is really good, there are always others too ready to blow the trumpet for one.

HENRY SEWELL,

40, Bloomfield-street, Upper Westbourne-terrace.

THE TAQUARIL MINING COMPANY—TELEGRAMS.

Sir,—On Jan. 17 the shares of the Taquaril Gold Company, Brazil, fell nearly 10s. each—of the cause of which small outside shareholders were totally ignorant, until the newspapers afforded the information by inserting a telegram which had been received, stating—"Stuff treated so far at stamps not rich."

I could not see anything in the telegram to create such a panic, depreciating, as it did, the market value of the mine to the extent of nearly 50,000l. in a few hours. Those who disposed of their shares at the reduced price will regret it; and if they had watched previous reports they would have retained their interest in the richest mine in the country. It is not possible that the richest three-head stamps ever erected could have been employed for 28 days crushing lode-stuff from the continuation of the shoots whence the gold samples were taken in July and September last, without producing more gold than that mentioned in the last telegram received. The object of the telegrams was, doubtless, to keep the company well posted up in matters as they occurred; but then shareholders should not be misled by merely a single word in a telegram—they should be guided by the mine reports.

The Taquaril Company's consulting engineer is a gentleman of high standing, and long and extensive experience. His opinion even of the geological character of a district, as to its probable value for gold mining, would be held in high estimation; and what his report, after a minute examination of a gold-bearing lode, and the excavations made upon it, be worth? Here is what he says in his report in September last concerning Taquaril:—"When I inspected Taquaril in June last, I informed you that I had seen sufficient to prepare me for startling results; since then the mine has been cleaned out, and ocular and tangible proof of its riches obtained, as gratifying as it is marvellous." Further on, in the same report, it is stated—"Taquaril has a vast rock formation of great promise; the one mine opened upon it is rich. What more then, I would ask, short of great piles of gold, which will by-and-by be forthcoming, could any company desire?"

The report of last July says:—"A sample of 6 tons produced 185 ozs. of gold. A sample of 6½ tons, taken in September last, and roughly treated, produced over 62 ozs. of gold." The report of October last says:—"Shoots, of which mention has been made, are under water, and until Hayman's shaft drains this section of the mine, and stopping operations are commenced, works upon them must remain in abeyance." The report of 15 Jan. (1870), says,—"The stamps were so worked upon the very stuff the telegram alluded to, says,—"Until the drainage of the old mine has been effected our operations upon this lode, and the rich shoots contained in it, cannot be other than very limited."

Therefore, it is clear enough that at the time the telegram was dispatched, not 1 lb. of ore from the richest shoots in the mine had been treated at the stamps. The stamps, of whatever power or capacity, had been employed in crushing debris, crushed stuff, fallen from the sides and roofs of old excavations, and which, although poor, was thrown away, to be thrown away. Yet, notwithstanding all this, at first sight of a telegram containing one unfavourable word, the people rushed to dispose of their valuable shares as much despair as if the mine had disappeared all under water.—Jan. 31. A SHAREHOLDER.

[For remainder of Original Correspondence see to-day's Journal.]

INSTITUTION OF MECHANICAL ENGINEERS.

The twenty-fourth anniversary meeting of members was held, on Jan. 26, in the Lecture Theatre of the Midland Institute, Birmingham.

Mr. JOHN RAMSBOTTOM (President) in the chair.

The SECRETARY (Mr. W. P. Marshall) having read the minutes of the previous meeting, the annual report of the Council was then presented, which showed the prosperous condition of the Institution; and reference was made to the successful and interesting meeting held in Nottingham last summer. The annual election of officers then took place, Mr. John Ramsbottom being re-elected President; and the election of new members was also announced.

The first paper read was "On the Mechanical Ventilation of the Liverpool Passenger Tunnel on the London and North-Western Railway," by the PRESIDENT. This tunnel, which forms an ascending incline of a mile and a quarter length from the terminal station in Lime-street, was worked until recently by a rope and stationary engine, to avoid fouling the air of the tunnel by the passage of locomotives, but the increase of the traffic having necessitated the abandonment of the rope, and the substitution of locomotives for bringing the trains up through the tunnel, it became requisite to provide some efficient means of ventilation for clearing the tunnel speedily of the smoke and steam after the passage of each train. A large exhausting fan has been designed by the writer for this purpose, which works in a chamber situated near the middle of the length of the tunnel, and draws the air from the tunnel through a cross drift, discharging it up a large tapering chimney that extends to a considerable height above the surface of the ground over the tunnel. The fan is about 30 ft. diameter, and is made with straight radial vanes; it revolves on a horizontal shaft at a speed of about 450 revolutions per minute, within a brick casing built concentric with the fan for the first half of the circumference, and afterwards expanding gradually for discharging into the base of the chimney, the air from the tunnel being drawn in at the centre of each side, and discharged to the circumference of the fan by the revolution of the vanes. The engine driving the fan is started by telegraph signal at each departure of a train from the terminal station, and the fan is kept running until the discharge from it becomes quite clear, showing that no steam or smoke remains in the tunnel; this is usually the case in about eight minutes after the time of the train entering the lower end of the tunnel, and the passage of the train through the tunnel occupies about three minutes. The fan draws air in at both ends of the tunnel simultaneously, and begins to clear the lower end immediately upon the train entering the clearing of the upper end commences as soon as the train has passed out of the tunnel, and as the fan is situated nearer the upper end of the tunnel than the lower, the clearing of both lengths is completed almost simultaneously. The fan is constructed so as to allow an uninterrupted passage through it for the air whilst the fan is standing still, and the natural ventilation thus obtained by means of the large chimney is found sufficient for clearing the tunnel during the night and some portion of the day, and the fan is only required to clear the tunnel during the day, and the engine exhaust, and the boiler flue discharging into the chimney. The fan has now been in regular operation for three-quarters of a year, and has been found completely satisfactory.

The next paper was a "Description of a Balanced Slide-Valve for Locomotive Engines," by Mr. WILLIAM G. BEATTIE, of London. This slide-valve is similar in shape to the old D valve, being made cylindrical at the back, and working inside a jacket of corresponding form, fixed in the steam-chest; the steam pressure is excluded from the back of the valve by two steam-tight packing rings, one at each end of the valve, which are fitted into grooves in the body of the valve, and are pressed outwards against the jacket by means of spiral springs. The valve is relieved of the heavy pressure of steam, which in ordinary unbalanced slide-valves forces the valve against the cylinder-face with a pressure that amounts in large engines to as much as 9 or 10 tons on each valve. The result has been found by experiment to be that the balanced slide-valves, which are made of cast-iron, require only about one-third of the power to move them that is necessary with the ordinary unbalanced valves, made of brass. The excessive wear and tear to which the ordinary valves and the link motion working thereon are subjected is thus avoided with the balanced valves, and there is a considerable saving, both in first cost and maintenance; there is also an important advantage in the facility with which the engine can be reversed with steam on. The economy of fuel consequent upon the saving in the power required to work the balanced valves has been found by the experience of continued working to amount to 2½ lbs. of coal per mile run; and a large number of engines, both passenger and goods, have been fitted with these valves on the London and South-Western Railway, some of which have been working for two years and a half, and have proved completely satisfactory.

The last paper was "On Whittle's Plan for Preventing Deposit and Incrustation in Steam Boilers," by Mr. GEORGE ADDENBROOKE, of Darlaston. The object of this plan is both to free boilers entirely from incrustation, and also to render harmless the impurities contained in the water, and prevent them from so thickening the water in contact with the heating surface of the boiler plates as to interfere with the due escape of the steam generated. This object is accomplished in a ready, inexpensive, and effectual manner, by placing loosely inside the boiler a lining composed of thin plates, extending over the entire heating surface of the boiler nearly up to the ordinary water level, with a uniform space of a few inches left between the boiler plates and the lining for the circulation of the water. In the bottom of the lining are made openings, or a single long slot, round the edges of which the lining plates are turned up to some height, so as to prevent the mud that collects inside the lining from passing out through the openings with the circulation of the water. The effect of adding the lining inside any boiler is that a very active circulation of the water is produced; the water in the narrow space between the lining and the boiler plates becomes heated by contact with the heating surface of the plates, and forms a continued rising current, which passes over into the interior of the lining, carrying with it all the earthy matter that has been precipitated by the evaporation of the water. In the comparatively quiescent water inside the lining, this earthy precipitate then settles down to the bottom of the lining, where it remains harmless in the form of soft mud, which never comes in contact with any part of the boiler-heating surface, and is got rid of by blowing-off at regular intervals as it accumulates. The lining has thus the effect of separating the mud from the water and rendering it harmless by simply mechanical means; but in the case of using chemical means by employing boiler "compositions," the mud is dissolved, and continues mixed up throughout the water, which consequently becomes so much thickened as to cause injury to the boiler by overheating of the plates. The uniform space between the lining and the boiler plates is preserved by short studs at suitable intervals, upon which the lining plates are

cottered; and any portion of the lining can readily be removed, whenever desired, for the purpose of examining the boiler plates at any part. Not only does the rapid circulation of the water over the heating surfaces prevent the formation of any incrustation upon the boiler plates, even when using very bad water, but in boilers previously incrustated with a considerable thickness of scale the application of the lining has resulted in the gradual and complete removal of the incrustation, the scale being washed over in fragments into the inside of the lining. Some of the boilers fitted with this lining have purposely been kept in constant work day and night for more than two months, with feed-water containing a large proportion of earthy matter, and without blowing-off; and on subsequent examination the boiler plates have been found clean and free from incrustation, while a large accumulation of mud was deposited in the interior of the lining, so much in excess of the quantity of mud to be removed from an ordinary boiler as to prove clearly the value of the lining in separating the deposit from the water. Considerable economy of fuel is found to result from the more perfect communication of heat to the water in the boiler, consequent upon the clean heating surface, and the continuous active circulation effected by the lining. Specimens were exhibited of the soft mud collected in the lining in different boilers, and of the hard scale formed upon the surface of the plates in the same boilers previous to the application of the lining.

LECTURES ON GEOLOGY—No. I.

The first of two lectures on the "Geology of the Neighbourhood of Dudley" was given in the Museum of the Mechanics' Institute last week, by Mr. WILLIAM MADELEY, secretary of the Dudley and Midland Geological and Scientific Society. The lecture was illustrated throughout with diagrams and specimens.

The lecturer, having been briefly introduced, gave his interesting and instructive lecture as follows:—

"There rolls the deep where grew the tree.

O Earth, what changes hast thou seen!

There, where the long street roars, hath been

The stillness of the central sea—Tennyson.

It was no poetic vision of the past which prompted the most philosophical of the poets of our day to speak of great changes on our earth, which, though familiar enough to all who have paid attention to geological history, seem strange and unreal to those who have not thought of these subjects. The object of geology is to unravel as far as we can the past history of our globe, to learn the great changes which have taken place by various agencies on its surface, and to study the almost innumerable extinct forms of animal and vegetable life, the fragments of which meet our eyes so especially in a district like ours, which has long been the scene of extensive mining operations. Geology, as a science, cannot make any claim to antiquity, for although we find that dating from the revival of learning in the 16th century, many thoughtful men collected and studied the fossils which they met with, it was not until the commencement of the present century that geology could take its place among the physical sciences. The first step to enable geologists to claim this distinction for the subject of their studies was the discovery that there was order and system in the arrangement of the sedimentary strata, and that these various strata could be distinguished from each other by the prevalence of certain peculiar forms of life. The man to whom we are chiefly indebted for this important discovery was William Smith, a civil engineer, who, as he travelled over England in his profession, turned his attention to this subject, and worked out independently, as far as he could, the great idea that the sedimentary strata were all deposited in a regular order of succession, and all contained fossil remains by which they could be identified. No doubt he used to bore his friends a good deal by rising his subject, but, for his labours, he has been justly rewarded by the title of the "Stratigraphical Engineer." Since his time, however, the respectability of the study has been somewhat advanced in public estimation, and the science has numbered among its ardent votaries such men as De la Beche, Buckland, Murchison, Sedgwick, Lyell, Phillips, Jukes, and a host of other thoughtful and intelligent men, who have now raised geology to the foremost rank among the inductive sciences. I cannot too strongly impress on you the importance of the fact that the sedimentary strata of our earth were all deposited in regular order, and I must call your attention to the diagram before you, while I briefly give you some little explanation of this matter.

You will observe that the various beds of rock (this word rock is used as a general term for all the beds) have each a distinct name, and are grouped together into many separate groups, which are again combined to form three great sub-divisions. Now if you meet with any one of these strata it will be found to be resting on an older stratum, and to be covered, wherever it is covered, by a newer bed. This fact is an invariable truth, and as I said before, it was the discovery of this fact that the several beds of the earth's crust could be identified by their fossil contents, that was required to elevate geology to the rank of a science. I must, however, caution you particularly on one point in reference to this order of deposition—that it does not necessarily follow that one stratum rests on the one which immediately precedes it on the chart, for perhaps circumstances were not favourable to the deposition of one stratum over the whole of the area covered by the preceding stratum.

You will understand better what I mean if you suppose the case of a great river, like the Ganges or the Nile, which annually carries down to the sea an immense quantity of mud, sand, &c., which is being deposited in the bed of the ocean. You will easily understand that if the sea-bed were examined in any part where this mud, &c., is not carried, we should not find this stratum in course of formation, and again on the dry land on the coast, if at any time the surface should subside, the mud, &c., would begin to be deposited on a very different base to the floor of the ocean. I wish particularly to get you to understand this question, because, though you are not yet acquainted with the details of the geological history of our country, you are already acquainted with the fact that the Silurian rocks, which are followed by the coal measures, without showing any trace of the lowest members of that series which are called the Mountain Limestone, and Millstone Grit. If we except the coal seams, we may say that the whole of the sedimentary strata were deposited under water, but after they were so deposited, they were subjected to many and mighty agencies, which in some instances, have swept them away altogether, in others have rearranged the fragments, and in others have consolidated them so that they are lost much of their original form. Great have been the changes which have taken place in the configuration of land and water, great the changes of climate, and almost immeasurable the time during which the great changes were being effected. The oldest rocks found on the surface in the neighbourhood of Dudley are the limestone hills of the Castle Hill and Wren's Nest, which belong to that division of the upper Silurian rocks which has been called the Wenlock Limestone. The name Silurian was given to that great group of rocks of which this forms a part, by the veteran geologist, Sir R. I. Murchison, from the fact that they were first discovered in that part of Wales which was formerly occupied by the British tribe of the Silures; while the particular bed of limestone and shales was called the Wenlock Limestone, from the fact that this bed is perhaps best seen in that particular locality where it forms a long range of hills called Wenlock Edge. We have, then, as I said before, no place in the neighbourhood where those rocks which lie below the Wenlock Limestone are to be met with. To find the Laurentian rocks we should have to go to North America, where they attain a thickness of 20,000 feet, and cover an area of 200,000 square miles. The Cambrian rocks are well seen in North Wales and are quarried very extensively for slate. The lower Silurian beds are to be found in North and South Wales and in Shropshire. The Llandovery beds are represented by a small outcrop in the neighbourhood of Walsall, and also by the Lower Lickey, near Bromsgrove, where the sandstone has been converted by heat into a compact mass of hard quartz, which is quarried for road-metalting. The lowest member, however, of the Silurian group to be found about Dudley is the Dudley Limestone, which is called by geologists the Wenlock Limestone and shale, and to be one of the oldest of the Silurian rocks, and examining without any difficulty, I would particularly direct your attention.

I said a short time since that all the sedimentary strata, excepting perhaps the coal seams, were formed under water, and this remark applies to all beds of limestone and chalk. They consist entirely of the remains of marine animals, which have secreted the carbonate of lime from the waters of the ocean. This has then been formed into corals, shells of mollusca, the carapaces of crustacea, and into other defensive armour of sea-bed animals, which lived and died in the deep sea, which at that time flowed over this district, till by the successive deposition of their remains, the vast masses of limestone, with which you are all so familiar, were gradually reared on the floor of the ocean; changed in some instances by chemical action into crystalline limestone, in others and many instances leaving their shelly coverings to testify to us the wondrous and varied forms of life which flourished in the seas of the Silurian epoch, and which have been assiduously collected by geologists from every part of the globe. To collectors of Silurian fossils Dudley Castle Hill and the Wren's Nest are sacred classic ground, for it is generally admitted that nowhere else are the fossils to be found in so good a state of preservation. This is most probably owing to the limestone having been formed in deep water, for you will easily understand how shells and the cases of shell-fish, as they are called, would soon get shattered and broken up if exposed to the grinding action of a sea-beach. No one who looks at the eyes of some of the trilobites can help being struck with the remarkable way in which the delicate structure has been preserved in a fossil state. Composed as they are, like the eyes of a fly or bee, of a number of distinct facets, they are objects of the greatest interest, and the facets can frequently be counted as accurately as can those of an insect of the present day. I must not dilate on the variety and beauty of the fossils of the Dudley Limestone. You see in this cases around you a collection of them which has few equals, and which contains especially such specimens of sea-lilies or crinoids as is not surpassed, I believe, in any other museum. If, however, you walk over the Castle Hill to the Wren's Nest you will find that the beds of limestone, instead of lying in the horizontal position in which undoubtedly they were originally deposited, have been raised up at almost right angles to each other in what geologists call an anticlinal, i.e., the beds lie or rest against each other. The position of the beds now is shown in the diagram before you. Now, we can come to no other conclusion than that the mighty convulsion which upheaved these rocks acted from beneath them in the direction in which there is the greatest elevation. What that agency was I do not pretend to say too positively. It might have been the subterranean throes of that great convulsion which upheaved the great dome of the Rowley Hills, or perhaps it was the result of an action of plication, which geologists tell us tends to throw the beds into folds, elevating or depressing them, and thus forming ridges and hollows, which can be frequently traced over districts where there is no evidence of volcanic action.

Be the cause, then, what it may, volcanic or otherwise, we see that some mighty power has been at work, and tossed them to rest against each other and form the anticlinal hills of Dudley Castle and the Wren's Nest. These beds consist of, first, a stratum of shale, which is nothing but consolidated mud, two beds of limestone, with an intermediate bed of shale, and probably other beds of shale and limestone beneath them. To what an extent the beds of limestone have been worked in former times you may judge by the ravines of the Castle, which have been formed by the limestone having been taken out for building the Castle, for smelting, and for making lime. By the map you will see that these hills of limestone are nearly due north and south, and that the beds slope on one side to the west, and on the other to the east. The stratum of shale, which is now admitted at the Wutsidale fens lies on the western side, and there you will find no doubt remember the steep sloping roof, which marks the dip of the beds. If you go to the Wren's Nest, again, you will find the roof in the long gallery is dipping sharply to the west, and that it is formed by excavating the lower band of limestone. There is a tunnel driven through the rock there, which you can traverse, passing through the intermediate bed of shale, and on the other side

you will see the upper band of limestone having a parallel dip with the lower band. You will, perhaps, understand this better if I call your attention to the accompanying section. The two bands of limestone vary a good deal in quality, the upper or thin bed containing more lime and less foreign earthy matter is used principally in the blast-furnaces of this district, while the lower or thick limestone is more impure, and is used for making lime. Passing from the Wren's Nest further to the north we find a continuation of the high ground as far as Sedgley Beacon. But in this part of the hilly range we meet with that division of the upper Silurian rocks which lies on the top of the Wenlock Limestone—the Lower Ludlow rocks and the Aymestry Limestone, the position of which you will see follows in ascending order. The examination of the position of these beds has not been accurately determined, owing no doubt to their small value in a commercial sense, compared with the lucrative measures of the Wenlock Limestone; but we can see that the whole of the range was subjected to the same elevatory force, though its intensity appears to be greatest towards the south. You will understand this fact better, perhaps, after I have said a little of the history of these limestone beds subsequently to their deposition at the bottom of a tranquil and deep sea. After their deposition they were covered over by thick beds of Lower Ludlow, Aymestry Limestone, and Upper Ludlow rocks, and this covered the upper Silurian extended over the whole of the district. By a geologist the evidence that can be adduced in confirmation of the ascending position, I assure you, be considered conclusive—that at Sedgley on the North, at Turf Hill on the west, and the Hayes on the south you find the Lower Ludlow and Aymestry Limestone, while still further south at the pits sunk in the last two or three years at Halesowen, Manor Farm, and at Wassall Grove, the very topmost beds of this Silurian series were most unexpectedly met with.

Now, if you were to sink a coal pit at Dudley Port, after passing through the coal measures, you would come down on the Wenlock Limestone, and then in the cause of this remarkable fact, that after a large deposit of sandstone and limestone has been made, a great portion over a considerable area has entirely disappeared? Why, the fact that the surface of these beds was slowly elevated above the level of the sea, and was then subjected to that erosion or wearing away by means of sea-waves, rivers, rain, and changes of temperature, which has produced that variety of hill and valley that we observe everywhere around us. This agency is called by geologists, denudation, and the powerful part displayed therein in wearing away and breaking up older formations to furnish materials for later deposits is a subject of the most interesting and instructive character. These upper Silurian rocks, then, were exposed for a long period to aerial denudation which swept some of them in parts or entirely away, and in others only left fragments here and there. The denudation, of course, was greatest when we only find the lower beds—at the Castle Hill and Wren's Nest. Now, if you take the height of the Castle Hill and Wren's Nest as 730 feet you will see that by adding the height of the Lower Ludlow rocks (the thickness of which is probably 500 feet), the top of these rocks at the Castle Hill would be much higher than the Sedgley Beacon, which is only 720 feet high—4-6, 30 feet higher than the Wren's Nest and Castle Hill. This, as I said before, shows that the elevatory force appears to have been greater about here than at Sedgley Beacon. I am speaking now of the present appearance of these limestone beds, but I must go back to the time when they were exposed to the action of the atmosphere, before they were covered over by coal measures, and before they were elevated to the anticlinal position in which we now see them. A long period must have elapsed during which these rocks were being gradually worn away, so that a period that it sufficed for the deposition of the Old Red Sandstone, the carboniferous limestone, and the millstone grit. The Old Red Sandstone attains in Herefordshire an aggregate thickness of 10,000 feet. No trace of this thick mass of sandstone is visible anywhere in the counties east of the Malverns, except a small patch near Kidderminster, and it is generally believed that during that period the neighbourhood of Dudley was dry land. Old formations were deposited there, which have now been removed, and the carboniferous limestone and millstone grit. The carboniferous or mountain limestone is largely developed at Froghall, Matlock, and in the Peak of Derbyshire, where Mr. Hull says it attains a thickness of 4000 feet. This is entirely absent about us, and so also is the next succeeding deposit, the millstone grit, which in South Wales is called by the miners the farwell rock, because they know that when they come upon it in their slinkings it is good-bye to any more coal. These, then, are the intervening strata which appear never to have been deposited in the neighbourhood of Birmingham, and during the time in which they were being formed elsewhere we find that a very great wearing away of the previously deposited beds was going on here. There was then a succession of other changes during a long epoch, which is called the carboniferous period proper, the period when the land was covered by these vast forests of vegetation, which were destined to become products of such immense importance to the comfort, prosperity, and advancement of the human race. These beds of coal, sandstone, and shale were deposited upon the eroded surface of the upper Silurian rocks, sometimes in hollows, sometimes on the level, and during this time the land had been left before it was again submerged. The coal measure period may be briefly described as a lengthened course of time during which the land was gradually subsiding again beneath the water, with long intervals of repose during which it was almost stationary. It was during the time that the slow subsidence was taking place that the sandstones, shales, and ironstone beds were formed, while the periods of rest were marked by the formation of the coal beds, which most probably represent a series of small swamps, and during the time of the coal measures the land was gradually rising and falling so many times may appear fanciful and hypothetical, but the fact that these changes are now taking place in various parts of the globe is proved by the most reliable evidence of trustworthy observers. It is the slowness of the change compared with the brief term of human life that is, perhaps, the greatest obstacle to our giving more ready belief to the fact. But it must be understood that as the astronomer asks you to believe in the distance of space of which the mind can form no adequate conception, so the geologist speaks of changes which have ranged over a period of time equally inconceivable.

I cannot give you in a short lecture many of the proofs that part of the beds of the coal were formed under water and part on dry land, but I would call your attention to two specimens, two casts of fossils, the one that of a great fish the megalichthys, which was found in the gubbin ironstone of this neighbourhood, and the other the head of a labyrinthodon, a gigantic reptile of the batrachian or frog family, which has just been presented to the Museum by Mr. Maw, of Bromley, and which was found in the coal measures of Shropshire a short time since. There is no doubt that this was an air-breathing animal, which could exist on the land, for we find in the muddy sandstones of the New Red period the foot-prints of the same order of animals, which were left by them as they wallowed along the sandy shores. There are many other evidences of a similar kind which might be adduced to prove that the beds of the shale and sandstone of this period were formed under water, possibly in the estuaries of great rivers in which the proportions of fresh and salt water at different times varied, but I do not time to explain these details, for the present I must confine myself to the general statement that it was so. Much has been written on the formation of coal, but no one now attempts to deny its vegetable origin. It has been thought by some that the remains of the coal plants were drifted, in the same way as the waters of the Mississippi carry down to the ocean the decayed leaves and stems of trees from the great forests through which, for hundreds of miles, it passes continuously. This may, perhaps, be the true origin of some beds of coal, pebbles, and in later deposits, but it is not the case in South Staffordshire. Here the coal-plants grew and decayed on the spot where they are now found as coal, and there is, therefore, not the least reason to doubt that the whole of the country around us was for a long period one great and dense forest of the most luxuriant vegetation. The coals always rest on a stratum of fire-clay, pure or impure, which was originally a bed of soft, tenacious mud, and into this mud the roots of the coal-plants thrust themselves. The fossil leaves of ferns, and the stems and roots of other cryptogamic plants, are, no doubt, mingled to you all around you, and you may see many specimens, showing that the trees of the coal period attained a very considerable size.

Now, if you examine any piece of coal from your coal-box you observe that it splits better in one direction than the other, that it is composed of a great number of thin strata, showing that layer after layer has been successively deposited. Sometimes there is a uniformity of structure extending through a considerable thickness, whilst sometimes you complain that the coal is bad and batty, which indicates, perhaps, a period of temporary interruption in the coal formation. Here the coal-plants grew and decayed on the spot where they are now found as coal, and there is, therefore, not the least reason to doubt that the whole of the country around us was for a long period one great and dense forest of the most luxuriant vegetation. The coals always rest on a stratum of fire-clay, pure or impure, which was originally a bed of soft, tenacious mud, and into this mud the roots of the coal-plants thrust themselves. The fossil leaves of ferns, and the stems and roots of other cryptogamic plants, are, no doubt, mingled to you all around you, and you may see many specimens, showing that the trees of the coal period attained a very considerable size.

Now, if you examine any piece of coal from your coal-box you observe that it splits better in one direction than the other, that it is composed of a great number of thin strata, showing that layer after layer has been successively deposited. Sometimes there is a uniformity of structure extending through a considerable thickness, whilst sometimes you complain that the coal is bad and batty, which indicates, perhaps, a period of temporary interruption in the coal formation. Here the coal-plants grew and decayed on the spot where they are now found as coal, and there is, therefore, not the least reason to doubt that the whole of the country around us was for a long period one great and dense forest of the most luxuriant vegetation. The coals always rest on a stratum of fire-clay, pure or impure, which was originally a bed of soft, tenacious mud, and into this mud the roots of the coal-plants thrust themselves. The fossil leaves of ferns, and the stems and roots of other cryptogamic plants, are, no doubt, mingled to you all around you, and you may see many specimens, showing that the trees of the coal period attained a very considerable size.

The Lepidodendron very much resembled this plant, but it grew to a height of 50 or 60 feet, and perhaps even higher. At the ends of the branches were seed-bearing organs, not unlike the cones of firs, and from them, when ripe, were distributed over the surface of the forest immense showers of spores or seeds. So dense was the downfall of these minute seeds that it has been said by some that nothing but a conglomerated mass of them, and the piece of coal before you is from one of these strangely-formed beds. Prof. Huxley, who a short time since gave a lecture on the formation of coal before the Bradford Philosophical Society, described the bed of coal from which this specimen was taken as consisting of nothing else than the seed and seed-cases of the Lepidodendron. The climate which was so well adapted to the development of this great growth of vegetation has been supposed to be somewhat similar to that of New Zealand, for there we find that ferns, club-mosses, and other orders of plants, similar to those of the coal period, flourish in the greatest perfection.

I have not time, and it would be uninteresting, to give you a list of the succession of the coal beds in the South Staffordshire coal field. You are all familiar with the thick or ten-yard coal, the brooch coal, the heathen coal, and at least the names of some of the other seams. The area over which the celebrated thick coal has been found extends from near Wolverhampton to Darlaston, thence to West Bromwich, by Oldbury to Halesowen, and thence to Kingswinford and Himley. Not that this seam has a uniform thickness of exactly 10 yards; and Himley. Not that this seam has a uniform thickness of exactly 10 yards; and Himley.

In some cases it reaches as much as 14 yards; whilst in the southern part of the district it is so separated by carbonaceous shales, &c., that it almost loses its identity, and, finally, at the pits lately sunk at Halesowen and Wassall Grove, its true nature is so different that I fear it will never pay to work. This fine seam of coal is becoming rapidly exhausted—so rapidly, indeed, that we may say, without fear of contradiction, that in another fifty years its existence will only be a matter of history, as being spread over the district where it is now being worked, but whether it may be found beneath the newer rocks which lie over the coal measures, either at the west near Kingswinford and Himley, or to the north in the direction of Wolverhampton, or to the east towards Saadwell and Smethwick, is a matter of which many of us have much doubt, however ardently we hope that the future may reveal to us new measures of this most valuable mineral.

George Stephenson called coal "bottled sunshine," and truly it may be said that in the consumption of coal we are employing the energies developed in primitive cycles of our earth, which energies, after having lain latent for ages

unknown, have at last been given for our use in God's own good time. Had it not been for coal we should never have had the steam-engine. Indeed, we may say that, either directly or indirectly, we are indebted to coal for almost all the blessings of civilisation. In my next lecture I purpose speaking of the great forces of upheaval and depression to which the coal measures were subjected after their deposition, and the occurrence of that mighty volcanic outburst which intruded a sheet of molten lava among the beds of coal over a great part of the district around us, and which is seen above ground in the high range of the Bowley Hills, Barrow Hill, and Pook Hill, near Walsall. And, further, I shall speak of that covering of newer rocks by which the coal measures were succeeded, and, most probably, entirely concealed; and, lastly, I shall allude to the evidences of the almost recent glacial epoch, when icebergs floated over the sea which then spread over the surface of the district, depositing on their way the pieces of rock which had been frozen into them before they commenced their voyages to more southern seas.

FOREIGN MINING AND METALLURGY.

The Belgian iron trade maintains a tolerably good tone. Orders for pig, plates, and merchants' iron arrive tolerably regular, and assure work for some time to come. Some orders for rails are also stated to have recently come to hand. It is affirmed, however, that all these new orders are on home account, and that scarcely any commands of work have been received from foreign countries, although the great works have not yet quite exhausted the contracts entered into before the outbreak of the war. This, if true, is very important, as Belgian metallurgy cannot exist merely on home orders. All that Belgian metallurgists can do is to patiently watch the course of events, and prepare themselves as well as they can for the revival which will probably take place in affairs as soon as peace is concluded. There will then be, no doubt, a good deal to do in the way of restoring shattered railways, and re-establishing a number of works of art sacrificed to the necessities of war. If Belgian metallurgists know how to profit from the circumstances which will probably open out before them they may realise large profits. The Belgian Society of Capitalists United with a Mutually Industrial Object commenced the payment on Wednesday of its second dividend for the exercise 1870, or 17 per share. The Produits Colliers Company will pay its dividend for 1870, March 1. The Blancy Coal Mines Company (a French concern) announces that the payment of the half-yearly interest due upon its shares Feb. 1 cannot take place in consequence of the investment of Paris. The town of Tournai has declined to renew its contract with the Belgian General Gas Company; the contract does not expire, however, until 1881.

The last advices from the Marseilles copper market report Toka at 80½; Chilean and Peruvian, 80½; and rolled red copper in sheets, 81½ per ton. In Germany transactions have been few in number, and have been generally confined to the supply of consumptive requirements. At Rotterdam, Russia has made 50 fms., and Drontheim, 50 fms. to 52 fms. Tin has not varied materially in price upon the Marseilles market. Upon the German markets tin has been firm. At Rotterdam business has been checked to some extent by the interruption of the navigations, while deliveries by railway have also become more and more difficult. Banca has fallen slightly, being quoted at 77½ fms. to 77¾ fms. Lead has been generally held at previous rates. The transactions which have taken place in zinc upon the German markets have been characterised by little animation.

The Belgian Coal Trade has been somewhat excited in consequence of the capitulation of Paris, which is regarded as virtually the end of the Franco-German war, and the consequent revival of Belgian coal mining industry. Paris is greatly in need of coal supplies, and the stocks accumulated by Belgian coal workers have now a fair chance of being speedily cleared off. Orders have come to hand to some extent from Holland and Germany, especially from Germany, where labour makes default more and more, and where various industries are almost threatened with extinction from the want of combustible and the ordinary transport facilities. The return of cold weather has also increased the demand of late for domestic qualities of coal, while some orders for coal have been given out by the Belgian mechanical establishments, which have received, as will be remembered, somewhat important contracts of plant, &c., for the Belgian State railways. Upon the whole, the Belgian coal trade is in as favourable a position as it could be expected to occupy, having regard to all the surrounding circumstances. The credit opened by the Belgian Department of Public Works for the acquisition of additional locomotives and plant is 178,000. A sum of 70,000, is also proposed to be expended for the construction of terminal lines, and sundry appliances intended to facilitate the loading and unloading of trucks. A further sum of 72,000, is to be expended for the extension of telegraphs and telegraphic apparatus. At the commencement of 1870 the number of trucks on the Belgian State railways available for the conveyance of goods and commodities was 9573, of these 5597 were coal wagons. The number of new trucks placed upon the lines in the course of last year was 1680, but during the same period 528 goods trucks were either demolished or devoted to the permanent way service, so that the net addition made to the rolling-stock of the system during last year did not exceed 1152. At the commencement of this year it will be seen, however, that the stock of trucks had been increased to 10,725, of which 6478 were coal trucks. Out of 1590 trucks ordered in the course of 1870, 527 still remained to be delivered at the commencement of this year. The Belgian General Railways Working Company has ordered 1400 trucks for use on the lines under its control, so that it is hoped that the want of railway rolling-stock, of which so much has been heard lately, will soon be a thing of the past. At any rate, the Belgian Government considers that substantial progress has been made in supplying the requirements of industrials, and the new order for trucks just given out has, consequently, been confined to 1000. Including the trucks ordered by the Belgian General Railways Working Company, and the new order for 1000 trucks now given out, it would seem that the rolling-stock of the principal Belgian lines will be increased before the autumn of 1871 to the extent of 4079 trucks. The Belgian Railways Working Company has transferred a portion of its lines to the State recently. Upon these lines there were 7982 trucks, of which 6171 were coal trucks. Altogether, then, the Department of Public Works expects to have shortly at its disposal 20,234 trucks, of which 13,780 will be coal trucks. It is expected, then, that the administration of the lines will be able to provide for all the demands which may be made upon it.

FOREIGN MINES.

ST. JOHN DEL REY.—The directors have received, per Gironde, the following report:—More Vello produce, second division of December, 11 days, 3108 osts.; yield, 2.463 osts. per ton.—Sinking New Shaft, December: A shaft sunk 3 fms. 3 ft. 2 in.; B shaft, ditto, 2 fms. 0 ft. 8 in. Better progress is now being made in both shafts by the use of dynamite, just arrived.

DON PEDRO.—Mr. F. S. Symons, Dec. 29: Produce: Weighed to date, 4490 osts.; estimate for month, 5590 osts. The lode at Alice's west is proving very fluctuating; it is yielding a large amount of general work, but none sufficiently rich for boxes. The cross-cut from Vivian's shaft to drain the bottom of the mine is progressing; every effort is being made to push on this essential work, though I fear we shall not be able to break ground from curve before annual documents leave; 2 fms. have been driven to date, and water is kept easily with the machine. At the middle adit the ground is wet and troublesome, necessitating an increased force of Englishmen; the ventilation is good, owing to an air-machine erected. Good duty accomplished in the reopening of Treloar's level where driven through Rookan. At Mato das Cobras the driving of the cross-cut is proceeding.

ROSSA GRANDE.—Mr. Ernest Hilcke, Dec. 28: No changes of importance have occurred in the appearance of the lode since last reported on. Although the lode in the stopes below the 50 has become more irregular and bumpy, it is still yielding well; that in the 40 west continues of good size, but as yet no improvement has taken place in the auriferous quality of the stone. However, notwithstanding this, I am in good hopes that our produce for the month will come up to 2000 osts.

GENERAL BRAZILIAN.—Capt. Thomas Treloar reports: Our operations generally since the 16th instant have not reached our usual mark. The weather has been unfavourable for surface works, and heavy rain operates against progress at the shallow adit St. Anna. At the latter place we are advancing but very slowly. At the shallow adit Itabira, too, our progress has been less rapid, owing to the presence of a stratum of compact iron mica slate, but it is thoroughly dry. No other point requires remark.

ANGLO-BRAZILIAN.—Mr. F. S. Symons, Dec. 29: Sick list favourable; attendance as high as can be expected at this time of the year. No alteration to report in the mine; works carried on with the usual regularity; supply of water in excess of demand, and water-courses in good order.

TAQUARIL.—Mr. T. S. Treloar, Dec. 28: Our works out of the mine at present are almost at a stand, weather being unfavourable, and attendance of force, as usual at this festive season, poor. The bottom of the old mine has been drained by Haymen's shaft, and we are now able to keep the stamps supplied with good stuff. Gold cleaned to date amounts to 1200 osts. This figure does not quite come up to our expectations. We have, however, a large quantity of good sand on hand to be treated, and as box-work is daily being obtained from main shoots in both lodes, and the standard of our ordinary mineral is

Hudson River Copper Company,

NEW YORK, UNITED STATES,

SULPHUR, COPPER, AND NICKEL MINES.

Incorporated Nov. 11, 1864, under the General Act of Feb. 17, 1848, and Amendment Acts passed since.

The shares are all fully paid.

The Capital is 1,500,000 Dollars (say £300,000) in 60,000 Shares of 25 Dollars (say £5 each).

THE TRUSTEES AND DIRECTORS ARE—

WILLIAM KEMEYS, New York—PRESIDENT.
ALFRED F. KEMP, Staten Island—TREASURER.
WM. N. ARMSTRONG, New York.
GEORGE M. WHEELER (of W. Bailey, Lang, and Co.), Westchester County.
EDWARD KEMEYS, New York.

SECRETARY—THEODORE CLARKSON, Brooklyn.

OFFICES.—29, WILLIAM STREET, NEW YORK.

BROKERS—LOUNSBURY AND FANSHAW, 8, Wall-street, New York.
COATES AND HANKEY, 24, Gresham-street, London.

AGENTS IN LONDON—CHILD, HORNBY, AND CO., 27, Lombard-street, London.

COUNSEL AND SOLICITORS—Mr. JOHN L. SUTHERLAND, New York.

Messrs. KIMBER AND ELLIS, 79, Lombard-street, London.

The mine of this company is situated at St. Anthony's Nose, on the Hudson River, about forty-five miles from the city of New York. It is within easy access from the city by railway, river, and road. The property lies in the township of Cortlandt, Westchester county, and the township of Phillistown, Putnam county, both in the State of New York, and can be readily seen by reference to the map. The present workings of the property are on 52 acres (freehold), which lie in Putnam county. Besides this, the company have in the same county a 15-years lease of 250 acres of land adjoining the 52 acres. There are 80 acres in Westchester county, which the company have the right to purchase for \$15,000 at any time before Nov. 1, 1872, on which property they only hold a lease for 15 years still to run. The company are paying for this lease \$1500 for this year (1870), and will pay \$2000 for 1871, and \$2500 for 1872 and subsequent years until the end of the lease, unless previously purchased, which it is the intention of the company to do. These lands cover everything known of the mine, and are in length about one mile. The river frontage of the property is 600 ft. in length, and is within 100 ft. of the channel of the river, where the company's new dock is being built, and is nearly completed, alongside which a vessel of 3000 tons can load.

CONTENTS OF THE MINE.—The mine now opened is found, as was anticipated, to be a solid mass of pyrites, consisting chiefly of sulphuretted iron and sulphuretted copper. Some nickel has been found in samples of the former assaying ½ per cent. to 6 per cent. If this should prove continuous, it will of itself be extremely valuable and profitable in addition to the sulphur and copper. These ores are mixed with quantities of hornblende, apatite, or phosphate of lime and spar. As a source of immediate profit, the sulphur ore only, which the mine furnishes in great abundance, is being worked and sold at a profit of about \$2½ per ton, while the rich copper ore is laid aside for the present, and stored to be dealt with hereafter.

WORK DONE.—Since the formation of the company, six years ago, they have had great difficulties to overcome in the dead work at the mine, and in opening up a market for the sulphur ore among the chemical manufacturers, both of which have now been accomplished. This period has been occupied in the construction and perfecting of the mine shaft, with connected level, tracks, cars, tramway, &c., besides getting considerable quantities of ore mined out and ready for delivery. The lower tunnel or adit level running into the vein is 300 ft. long, and the shaft is 180 ft. deep. Not having been run to exactly meet, the two have been connected by large stopes in the vein. Splendid ventilation has been thereby secured. Being from 700 to 800 ft. above the natural drainage of the country, the mine is insured against any serious trouble from water, in the pumping is required. At the water now entering the mine comes from the surface.

PRESIDENT CONDITION.—The directors are taking steps to procure the speedy completion of the new dock at the termination of the new road just finished, by which a saving of 50c. per ton or more will be effected in the transportation of the ore to the ships. The new road is a continuous inclined plane of about one mile. The road heretofore used is circuitous to the extent of about three miles, and has some up grades. The company has a market already for its sulphur ore at \$5 per ton. It has the additional advantage of a customer in the immediate neighbourhood, in a firm which has erected large vitriol (sulphuric acid) works alongside the company's new docks. It is found that the ore makes as high a quality of vitriol as the Sicilian sulphur, and burns well. The manufacturers are learning to roast the ore now to such perfection as to extract all the sulphur to within a small percentage. The directors believe they have one of the best mining captains in the country. He has had many years' experience in England, and more particularly for the last ten years, in the State of Vermont, where he has managed a mine of similar character with great success. His name is Thomas Pollard. There are considerable quantities of sulphur and copper ores already mined out and lying ready for sorting and delivery. Last year the company worked out (besides getting through the dead work) about 5000 tons of sulphur ore, and sold the same for about \$25,000 (say, \$5000), which must be considered a fair beginning.

The accommodation and buildings at the mine consist of the house at the mine, where the men are boarded, which is 40 ft. long, 23 ft. wide, and two stories high, lined with bricks, with an addition, 20 by 15 ft., one story high, used as a wash-house. A large earth cellar, near the house, for keeping meats, vegetables, &c. (The house has had as many as forty men in it, and is well built, and comfortable.) The superintendent's house, two stories high, a very good house, new, and in all respects convenient and suitable for the purpose. A stable, with room for six horses, harness, &c. A new thoroughly-built blacksmith's shop alongside the track at the mouth of the adit level. An office by the side of the water entering the mine, as firm to-day as it did three years ago. The men change their working clothes for clean ones, and a substantial shed over the dump and sorting-ground. A few small houses, costing \$500 each, would be very desirable as residences for married miners who have families, the boys working well as sorters of ore, and in many other ways being as useful as men, and much less expensive. The question of their erection is now under consideration. Many of the men find board with the surrounding farmers' families, and prefer to live in that way. The works are well planned and shaped. The rock stands, without timber or masonry, as firm to-day as it did three years ago.

COST, VALUE, AND PROFIT PER TON.—The net profits on the sulphur ore, now sold at \$5 per ton, is about \$3 per ton, thus:—Contract to miners to deliver the ore on the dump, per ton, 75 cents; sorting, per ton, 25 cents; hauling to dock, per ton, over new road, 50 cents; all incidental expenses, office, superintendent, &c., 50 cents; total, \$2. Sold at the dock, per ton, \$3; profit, \$3 per ton. The net profit on 6 per cent. copper ore worked on the spot for metal only is estimated at \$14 per ton. Many of the expenses are taken too high, and will not be materially increased whatever quantity of ore be taken out in a given time. The improvements now going on will still further reduce expenses. It must not be supposed that \$5 per ton is the highest price that could be obtained for the sulphur ore. It is put at this low figure at present to encourage the manufacture of sulphuric acid therefrom.

QUANTITY OF ORE.—The mine is, properly speaking, a huge quarry of sulphur ore, actually visible, and open to the inspection of anyone. There is nothing imaginary or speculative about this, it is only a regard to copy and nickle, that it can be looked upon as a mine, and, therefore, upon this point only to

▲ FEW SHARES IN THIS COMPANY REMAINING UNSOLD ARE TO BE OBTAINED AT £2 PER FULL PAID SHARE, ON APPLICATION TO THE BROKERS.

showing improvement, I still hope and believe the result of the month's working will be satisfactory. On the 24th inst. I desired Messrs. John Moore and Co. to forward the following telegram to the directors:—Bottom of old mine dry. Improvement at stamps. Main shoots in both lodes yielding richly; produce looking well. By this mail:—Gold shoots to date, 1200 osts.; shoots strong; large quantities of sand still to be treated.

ECLIPSE (Gold).—Capt. Barratt reports for December as follows:—Main shaft is down 66 ft. below the 160 ft. level, and the shaftmen have commenced to drive north on the Eclipse lode, which is 7 ft. wide, carrying a branch of quartz 8 in. wide on the footwall, containing a little galena and silver ore, but not of much value. There is also a similar branch under the head-wall. The middle part of the lode is quartz and oxide of iron, auriferous, but does not contain sufficient gold to be put through the mill. This end, being near the junction of the Eclipse and Barratt's lodes, is a little disordered, but a few feet further north I anticipate the lode in it will again become highly auriferous, and a good one. Barratt's lode, which ranges from 6 to 20 ft. wide, contains very rich deposits of galena, grey sulphures of silver, vitreous silver ore, green and blue carbonates, and muriate of silver—exceedingly rich ore. We broke, a day or two since, a rock 150 lbs., that will yield much more silver than the average of the samples sent you by last mail. The stopes in back of the 160 ft. level are turning out just as usual; lode (auriferous part) about 3 ft. wide. We shall next week commence to stope auriferous ore from the back of the 160 ft. level. This mill is almost completed, and I expect to commence stamping about the middle of next month. Owing to unforeseen delays we were kept back a little. Quartz hauling has commenced, and all the works connected with the mine and reduction works are being carried on with all possible speed.

ALMADA AND TIRITO CONSOLIDATED (Silver).—Extract of a letter received Feb. 1 from the company's engineer, under date Dec. 19: "In the tunnel end north (beyond the slide) the lode looks well, as it does also where we are stoping across it. Its hardness will consume time before we have it in good stoping condition. That the lode should promise productiveness at this point is very encouraging, as it happens to be under a portion of the Providencia pertenencia that I believe never yielded much. The stopes continue as for some time past, and looking at the mine generally I consider we are now safe on the question of full supply for the 30 heads of stamps."

UNITED MEXICAN.—Dec. 22: Mine of Jesus Maria y Jose: In the system of working this mine I can report no variation, except that our extraction from the reserves during the past month has been a little better, both in quantity and in ley. Many of the buzones have been absent from their work, but they are returning, and we have about 50 campos (buscon works) in the mine. The November accounts show a loss of \$4456, but in the month of December we have a raspa to close the year's accounts, and I hope with confidence that the result will be better than in November.—Mines of Remedios: In this mine we have been doing some work on the reserves in San Eligio and San Joaquin, and thereby have brought up our sales. Our quarterly accounts in this mine closed on Nov. 26, and showed a profit of \$7693, of which \$4487 be-

come extent speculative. The directors base their calculations of future earnings and profits upon the actual facts and experience derived from the last six years' working, and more particularly upon that of the past year. These calculations are verified by Prof. Raymond, Mining Engineer to the United States Government, who reports that the mass of solid ore now exposed to view, and ready for breaking down and carting away for sale, amounts to at least 40,000 tons:—In the stope from the cross tunnel to bottom of the shaft (say), 16,000 tons; in the stope from the upper drift down to the large tunnel stope, 10,000 tons; in the ground south of the shaft, 14,000 tons; total, 40,000 tons of sulphur ore, in extracting which some 4000 to 5000 tons can be set aside as 6 per cent. copper ore. In the ground south-west of the shaft there are about 45,000 tons more easily to be opened up, without any dead work. There cannot reasonably be any doubt of the continuance of the deposit in depth, and there is at least 700 ft. in perpendicular height yet. Besides the deposit now worked upon there are, doubtless, parallel recurrences in the same zone. Where one rich ore-body thins out another will be found to set in, and this metallic series continues in the property for at least a mile, as is indicated by the outcrops traced for the distance. Hence the company can at any time open upon some other outcrop, and double the rate of production. The capacity of the mine is, therefore, practically beyond limit.

ESTIMATE OF PROFITS.—Upon the foregoing moderate calculations, there will be a net profit on the ore now in sight or available without any dead work being needed, as follows:—In tunnel stopes: sulphur ore, 35,000 tons, at \$10, \$350,000; copper ore, 5000 tons, at \$14, \$70,000; profit \$420,000. In south-west ground: Sulphur ore, 40,000 tons, at \$3, \$120,000; copper ore, 6000 tons, at \$14, profit \$84,000 (\$16,800); total, \$579,000 (\$75,800). It will probably take, with the present force of men, about three years to extract the above, but it depends entirely upon the number of men the company choose, or their finances permit, to be employed. It can be pushed ahead much faster than this. However, calculating at this slow rate, the above would give a return equal to 8½ per cent. per annum on the nominal capital of \$1,500,000 (\$300,000). The extraordinary shipping advantages of the company, and the great and increasing demand for the ore among acid and vitriol manufacturers, render it safe to look forward to a steady prosperity.

ASSAYS.—The company sent to London some samples of all the ores (selected promiscuously by Mr. Alfred Kimber, C.E., Associate of King's College, London, who visited the mine for the purpose) to be assayed by Mr. Frederick Claudet, of London. These samples, rich and poor together, were analysed and reported as follows:—No. 1 samples, magnetic pyrites, No. 2 samples, copper pyrites, intermixed with magnetic pyrites. Sulphur, No. 1, 34.45; No. 2, 29.52; iron, No. 1, 51.25; No. 2, 37.56; copper, No. 1, .83; No. 2, .828; nickel and traces of cobalt, No. 1, .60; No. 2, .40; carbonate of lime, No. 1, 3.50; No. 2, .463; insoluble rock, No. 1, 8.40; No. 2, 18.40; moisture, No. 1, .20; No. 2, .20; oxygen and loss, No. 1, .77; No. 2, .95; total, No. 1, 100.00; No. 2, 100.00. Mr. Alfred Kimber writes that "as a pyrites mine (sulphuretted iron) it is a great success, and the quality is inexhaustible. The samples sent to me may be taken as a fair estimate of the quality as regards the sulphur. From the appearance of the ore now coming out, the future of the mine is very good as regards copper. You cannot find a single piece of ore that does not show copper, and the quantity of rich copper ore seems to be increasing." The company had a lot of 50 tons of ore tested on July 14, 1870, by Prof. Chandler, at the School of Mines, Columbia College, New York, and received his certificate that it contained 7.60-100ths per cent. of copper.

PROSPECTS AS TO COPPER.—The miners are steadily coming to more copper, and all who see it have but one opinion, which is that it is a great copper vein. The numerous heaps of copper ore, more or less concentrated, which lie about the dumps cry aloud to be utilised, but until recently there have been no American purchasers of 3 per cent. to 7 per cent. ores of copper. Professor Raymond, before mentioned, reports that "as the work has progressed it is found that the magnetic sulphuretted iron has become purer and massive, and contains less of hornblende and felspar, while the sulphuretted copper in the stope found in the hanging wall is richer," and he "emphatically repeats the opinion that in depth the percentage of copper will increase. It is confirmed by the actual experience of the mine." Mr. Alfred Kimber writes "that he feels more and more convinced every time he goes to see the mine of its great future. The ore is fast approaching that point when it will be difficult to know how to sort it. The copper is more evenly distributed throughout the sulphur, and is increasing to such an extent that it will be difficult to say whether it shall be called sulphur ore, and sold at \$5 per ton, or whether it would pay to sort for copper at \$3 a unit, which for 6 per cent. copper ore at \$3 a unit would give \$18 per ton. The dead work to be done in the mine is positively nothing, and the ore is coming out so free from rock that it only requires sorting for copper."

The running expenses owing to the company did not exceed \$8500 (1700l.) on Aug. 31, 1870. The money owing to the company for sulphur ore, sold and delivered, amounted to \$9000 (1800l.) on the same date. The balance of cash in the hand of the treasurer is \$2000 (£400). The company have no debts or incumbrances of any kind, with the exception of a mortgage for \$5730 (£1140) remaining on the Putnam County property, which the company are ready to pay off whenever required. The fiscal year of the company ends on the second Monday in October of each year. The annual meeting of stockholders is held at the office on the fourth Monday in October of each year, at twelve o'clock. The principal office of the company is at 22, William-street, in the city of New York, where the books are kept.

A copy of the constitution and bye-laws of the company, and of the laws of the State of New York relating to the same, can be seen at the office of the company, and of Messrs. Kimber and Ellis, solicitors, 70, Lombard-street, London, by whom shares will be received and forwarded, when required, for registration. The shares are transferable by simple endorsement of the share certificates, and the holder can have his own name registered in the company's books with the pleasure, on production of the certificates so endorsed.—W. KEMEYS, President; ALFRED F. KEMP, Treasurer; T. CLARKSON, Secretary.

[All the figures have been reckoned at \$5 to the £1 on both sides, for convenience of calculation by English shareholders.]

longed to the company.—New Concern: Adit of San Cayetano and Mine of Buenos Ayres: The adit has been continued with some difficulty, as well as the frente de Buenos Ayres, which is going eastwards to meet it; I confidently expect to have this communication made early in January. We can then proceed to further exploration.—Mine of San Antonio de la Ovejera: In this mine the cross-cut is now 34½ metres. On Dec. 16 the hard rock gave way to more favourable country, and the vein cannot now be far off; it must have got very steep in the depth. We shall cut it at about 370 varas depth from where it crops on the mountain above.

LUSITANIAN.—Jan. 24: At Taylor's engine-shaft, below the 140, the lode is worth 3 tons per fathom. In cutting pit in the 140 the lode is worth 2 tons per fathom. In the 140, east of Taylor's, on Basto's lode, the lode is 5 ft. wide, composed of quartz, and is very wet. In the 130 east the lode is 4 ft. wide, and worth ¾ ton per fathom. In the 130 west the lode is 1½ foot wide, worth 1½ ton per fathom. In the 120 east the lode is 2 ft. wide, and worth ¾ ton of ore per fathom. In the 110, east of River shaft, the lode is 7 ft. wide, composed of loose quartz and large runners of country, with copper ore and nickel together, worth 1 ton per fathom. In the 90, east of ditto, the lode is 4½ feet wide, composed of quartz and ore, worth ½ ton per fathom. In the adit, west of Perez's shaft, the lode is a very small flooken. In the 38, east of Taylor's, on Mill lode, the lode is worth 1 ton of ore per fathom. In the 38, west of slide lode, the lode is 2 feet wide, composed of country with open branches. In the rise above the 90, against the winze in the 82, east of River shaft, on Basto's lode, the lode is 4 feet wide, and worth ½ ton of ore per fathom. At the winze in the 83, below the 70, the lode is 1 foot wide, composed of schisto. In the 85 the lode is worth 1 ton of ore per fathom.—Carvalho: In the 60, north of incline, the ground is a very hard, tight gneiss. In the 60, east of incline shaft, the lode is unproductive. In the 50 east the lode yields lead worth ¼ ton per fathom. In the 40 east the lode is 2½ ft. wide, composed of quartz and stones of lead. In the 30 east the lode is 6 feet wide, worth ½ ton of lead per fathom. In the adit level, west of incline shaft, the lode is 2 ft. wide, worth 1 ton per fathom.

[For remainder of Foreign Mines see to-day's Journal.]

SMELTING IRON.—The invention of Mr. J. BARCLAY, Kilmarnock, consists in the construction of the surface and joints of the pipes through which the air passes, and in which it is heated. The interior and exterior surfaces, or either one of them, are or may be corrugated or fluted. The joint of each pipe by which it is connected to the portion of the blast mains within the heating-stove consists of two projections, which enter into correspondingly shaped recesses or sockets formed in the upper side of the main, so that a complete connection may be made around the entire end by rust or other cement.

London: Printed by RICHARD MIDDLETON, and published by HENRY ENGLISH (the proprietors), at their offices, 26, FLEET STREET, E.C., where all communications are requested to be addressed.—February 4, 1871.